Star Stuff

The Ford Amateur Astronomy Club Newsletter

Volume 5, Number 11 November 1996

GALILEO SPACECRAFT MAKES SEVERAL NEW DISCOVERIES

HIGH-ALTITUDE IONOSPHERE FOUND AT IO

Scientists participating in NASA's Galileo mission have discovered that the Galileo spacecraft may have flown though a dense, high-altitude ionosphere during its encounter with Jupiter's volcanic moon Io last December. This discovery suggests that Io's atmosphere is time variable and is made of volcanic gas lofted to very high altitudes.

An ionosphere is a region of electrically charged gas that exists at the top of some planetary atmospheres. The surprising discovery is being reported by Galileo scientists this week at a meeting of the American Astronomical Society's Division of Planetary Sciences held in Tucson, AZ, along with other Galileo results, including remarkable new images of the planet and its moons.

"Sensors on the spacecraft found a very dense region of ionized oxygen, sulfur and sulfur dioxide at 555 miles on Io that must be pumped into that region by Io's relentless volcanic activity," said Dr. Louis A. Frank of the University of Iowa, principal investigator on Galileo's plasma science experiment. "Instead of being swept away by Jupiter's rotating magnetosphere as anticipated, the ionized gases surprisingly remain with Io," he said.

"Passage of the Galileo spacecraft through an ionosphere was not expected because images of the volcanic plumes previously taken with the Voyager spacecraft indicated that the plume heights extended only to a few hundred kilometers or less," Frank said. A radio occultation by the Pioneer 10 spacecraft in 1973 indicated ionospheric heights only about 30 to 60 miles above the surface. "No one expected to see this at 900 kilometers' altitude," he added. The difference between what Pioneer saw and what Galileo has observed indicates that Io's atmosphere and ionosphere are variable and may grow and shrink with more or less volcanic activity.

The results may lend credence to previous theories proposed by Galileo project scientist Dr. Torrence Johnson of NASA's Jet Propulsion Laboratory (JPL), Pasadena, CA, that invisible "stealth plumes" deliver volcanic gases to great heights above Io. Io's weak gravity field apparently permits the invisible gases emanating from the volcanoes to reach extraordinary heights far beyond the lower altitudes achieved by the dust and other volcanic ejecta that reflect sunlight and can be seen in images, Frank said.

IO ELECTRON BEAMS

In a related finding, the energetic particle detector on the spacecraft measured intense, bi-directional electron beams that are aligned with Galileo's magnetic field in Io's vicinity. The beams are similar to those that impinge on Earth's atmosphere to produce aurora and also positive ions and electrons in Earth's atmosphere. Dr. Donald J. Williams, principal investigator on the energetic particle experiment from the Johns Hopkins Applied Physics Laboratory, said the electron beams span the energy range of 15 kiloelectron volts to 190 kiloelectron volts and represent an energy deposition into Jupiter's atmosphere of up to one billion watts.

"This is sufficient energy input into the Jovian atmosphere to produce visible auroral emissions," Williams said. "These beams are a signature of remarkable particle acceleration processes that occur in the vicinity of Io - processes that are thought to be linked to Io's motion through Jupiter's plasma and magnetic field environment." Additional work is required to determine whether the beams play a role in producing some of the auroral emissions observed in Jupiter or if they are related to radio emissions that have been correlated with Io's orbital motion.

The electron beams also must have a role in maintaining the Io torus, the doughnut-shaped cloud of ionized gases that flows between Jupiter and Io, Galileo scientists said. Auroras in Io's atmosphere is one likely result of the electron beams, they reported, and the two-way electron highway that the beams produce between Jupiter and Io must contribute to some of the auroras observed in Jupiter's atmosphere as well.

IO VOLCANO SHIFTING?

Several images recently returned by Galileo show new details of surface features on the moons Ganymede and Io. One new image of the active volcano Prometheus on Io has been compared to one of the same feature taken by NASA's Voyager spacecraft 17 years ago, and shows that the plume is now erupting from a position about 46.5 miles west of where the hot spot resided in 1979. It is not known if the plume source is the same or if the plume is now emanating from a new source. Overall, scientists studying Galileo images of Io are observing that a wide variety of surface changes have occurred in the nearly two decades since a spacecraft last visited Jupiter's system.

FROSTED RIMS ON GANYMEDE

Bright white areas seen around the circular rims of high-latitude impact craters on Ganymede in new Galileo images of that moon are likely water-ice frosts, Galileo scientists report. Even though the Sun is shining from the south, the north-facing walls of the ridges and craters are brighter than the walls facing the Sun. Images of regions elsewhere on Ganymede show more details of the remarkable juxtaposition of newer and older fractured and faulted terrain that characterizes so much of this big moon's surface. A stereoscopic view of Ganymede has also been produced with two images of the Galileo Regio region (one was taken during the first Ganymede flyby in June and the second was acquired in the September flyby). The image, which was computer-reconstructed by imaging scientists at JPL, shows new topographic information about the moon.

Galileo science team members are reporting on numerous other new findings about Jupiter and its moons:

The photopolarimeter radiometer experiment produced heat maps of the Great Red Spot on Jupiter, the day side of the moon Europa, the night side of Io, and both the day and night sides of Ganymede during the spacecraft's flyby of Ganymede in June. The images of the Great Red Spot show temperatures of the atmosphere at the 250 and 500 millibar pressure levels, much like terrestrial weather maps. The Great Red Spot is colder than its surroundings, consistent with earlier Voyager and Earth-based observations in which the spot is modeled as an anticyclonic vortex with central up-welling balanced by subsidence at its edges.

The radiometer also produced temperature data for Io indicating a nighttime temperature about -375° to -380° F. The first midday temperature for Europa, -229° F has allowed the radiometer instrument team to determine that the moon has a more porous or "fluffy" ice surface than the other moons. Researchers said that such porosity indicates Europa's surface is covered with finely powdered ice grains. The near-infrared mapping spectrometer instrument and Galileo's solid state imaging camera measured hot regions on Io including erupting volcanoes and individual volcanoes, finding temperatures between 296° to 656° F.

On Callisto and Ganymede, the near-infrared mapping spectrometer found surface features indicating the presence of hydrated materials, or possibly carbon dioxide frost. ☆

WHAT IS A COMET MADE OF?

UMass Astronomers Report Comets May Have Introduced Interstellar Chemicals to Earth

AMHERST, Massachusetts
The brightest comet of 1996 — Comet Hyakutake — may have shed some new light on a question that astronomers have asked for centuries, "what is a comet made of?" Many scientists believe that the volatile components of comets are the nearest things we know to material untouched since the time of the formation of the Solar System, and so provide a record of the conditions that prevailed in our primitive solar nebula.

Writing in the latest issue of the journal Nature (Oct. 3, 1996), University of Massachusetts radio astronomer William Irvine and colleagues suggest, based on recent observations of Comet Hyakutake, that comets consist of the same material that made the stars themselves, and these dramatic celestial objects may have been a source of some organic materials on Earth. Irvine, along with UMass colleague Peter Schloerb and UMass doctoral candidate Amy Lovell, help organize an international team that used radio telescopes to observe Comet Hyakutake when it blazed across the sky in the spring of 1996. Millions of non-scientists also viewed Comet Hyakutake with only binoculars or the unaided eye, as it made a spectacular pass near planet Earth.

Comets are small celestial bodies that orbit the sun and thought to consist mostly of dust particles and icy materials — what some astronomers informally refer to as "dirty snowballs."

Irvine says that the observational evidence from viewing Hyakutake by several powerful radio telescopes positioned around the world — including the 14 meter Five College Radio Astronomy Observatory located near Amherst — suggests that it contains some of the same material found deep in interstellar space.

"The detection of hydrogen isocyanide (HNC) in Comet Hyakutake supports the idea that interstellar gases were incorporated into the nucleus of this and other comets." says Irvine. Interestingly, the hydrogen isocyanide was found in the same ratio to another molecule — hydrogen cyanide (HCN) — as that observed in interstellar clouds. This measurement supports the idea that interstellar gases were incorporated into the nucleus of this and other comets, perhaps as ices frozen onto interstellar grains.

Scientists know that material found in interstellar clouds — such as hydrogen, carbon, nitrogen, and oxygen — form the basic chemistry of life as we know it. Some astronomers have theorized that comets could have been a delivery mechanism for pre-biological organic matter that ultimately helped develop, or even triggered life on Earth.

Irvine and Schloerb explain that organic molecules might have congregated into comets in interstellar space billions of years ago. Identifying the exotic gases and solid particles found in comets could tell us much about the conditions under which the solar system, and especially Earth, were formed.

Irvine says that most astronomers believe the chemical and physical processes that helped set the stage for the origin of life on earth occurred over some ten billion years before the formation of the Earth.

"Chemical and physical processes relevant to the origin of life have been taking place ever since the beginning of the universe, roughly 15 billion years ago," says Irvine. "It's interesting to note that with the exception of phosphorus, the chemical elements of which we are made — hydrogen, carbon, oxygen, nitrogen, and sulfur — are among the most abundant in the universe."

Irvine says that largely as a result of extensive observations using radio telescopes, a rich and complex chemistry is known to exist in dense interstellar space. Does the presence of organic materials in comets make it likely that life also formed in other parts of the universe? The answer isn't clear.

Irvine believes that the nature of the Earth might have been much more influenced by interstellar material than has been believed.

"The basic building blocks of life are out there," Irvine says, "and at least some of the organic matter in comets and meteorites has reached, and continues to reach, the surface of the Earth relatively unaltered." ☆

STAR STUFF
Monthly Publication of the Ford Amateur Astronomy Club

Star Stuff Newsletter
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1996 CLUB OFFICERS

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GENERAL MEETINGS

The Ford Amateur Astronomy Club holds regular general meetings open to the public on the fourth Thursday of the month at 5:00 PM. Meetings are held at the Ford Motor Credit Company (FMCC) building, Northeast of the World Headquarters build in Dearborn, in conference room 1491, lower floor, East side of the building.

OBSERVING SITE

The Ford Amateur Astronomy Club has an established observing site, by permit, at the Spring Mill Pond area of the Island Lake Recreational Area in Brighton, Michigan located near the intersections of I-96 and US-23. Members are responsible for opening and closing the gate after the parks 10:00pm closing time. The combination for the lock should be available on our hotline number. Always close the gate behind you after 10:00pm whether entering or leaving the park.

OBSERVING HOTLINE NUMBER - (313) 39-05456

On Friday and Saturday nights, or nights before holidays, you can call the hotline number up to 2 hours before sunset to find out if we will be observing that night. Assume that any clear Friday or Saturday night is a candidate observing night unless something else is going on or none of the club officers are able to make it.

WWW PAGE

Computers inside the Ford network or on the Internet can access the F.A.A.C. web page at one of the following addresses:

Ford Intranet: (new address soon)
Internet: http://www.id.net/~erik/faac.html

MEMBERSHIP AND DUES

Membership to the Ford Amateur Astronomy Club is open to both Ford and Non-Ford Motor Company employees. The general public is also welcome to join. The dues structure is as follows:

Annual Individual/Family	$20.00
Lifetime Membership	$100.00

Membership benefits include a subscription to the Star Stuff newsletter, discounts on subscriptions to Astronomy and/or Sky & Telescope magazine(s), after hour use of the observing site at Island Lake, and discounts at selected area astronomical equipment retailers.

NEWSLETTER STAFF

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NEWSLETTER SUBSCRIPTION

A yearly subscription at a rate of $12.00 is available to those who are not members of the Ford Amateur Astronomy Club. Subscriptions are free to other astronomy clubs wishing to participate in a newsletter exchange.

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NOVEMBER 1996

SUN	MON	TUE	WED	THU	FRI	SAT
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

Nov 02 Comet Helin-Roman-Crockett Perihelion (3.489 AU)
Nov 02 Venus at Perihelion
Nov 02 Asteroid 584 Semiramis Occults PPM 067814 (11.2 Magn. Star)
Nov 03 Comet 1996 Q1 (Tabur) Perihelion (0.84202 AU)
Nov 03 Last Quarter Moon (2:53 am)
Nov 04 Taurids Meteor Shower
Nov 05 Asteroid 52 Europa Occults 12.0 Magnitude Star
Nov 05 Comet Tritton Perihelion
Nov 08 Jupiter Occults Galileo
Nov 09 Comet Mrkos Perihelion (1.413 AU)
Nov 09 Asteroid 74 Galatea Occults PPM 236882 (9.1 Magnitude Star)
Nov 10 New Moon (11:16 pm)
Nov 10 Asteroid 3596 Meriones Occults PPM 207237 (9.7 Magn. Star)
Nov 12 Jupiter Occults SAO 187632 (6.9 Magnitude Star)
Nov 13 Asteroid 1074 Beljawskya Occults PPM 144149 (8.8 Magn. Star)
Nov 14 Jupiter Occults SAO 187669 (9.1 Magnitude Star)
Nov 14 Andromedids Meteor Shower
Nov 15 Asteroid 752 Sulamitis Occults PPM 120231 (6.0 Magnitude Star)
Nov 15 Asteroid 838 Seraphina Occults PPM 154591 (10.1 Magn. Star)
Nov 17 Leonids Meteor Shower
Nov 17 First Quarter Moon (8:10 pm)
Nov 20 Asteroid Interamnia at Opposition
Nov 23 Asteroid 1993WD Near-Earth Flyby (0.2466 AU)
Nov 23 Asteroid Davida at Opposition
Nov 24 Full Moon (11:10 m)
Nov 25 Asteroid 1177 Gonnessia Occults PPM 181208 (7.5 Magn. Star)
Nov 29 Asteroid 4179 Toutatis Near-Earth Flyby (0.0354 AU) ☆

MEETING ANNOUNCEMENT

The Ford Amateur Astronomy Club (FAAC) holds regular general meetings on the fourth Thursday of each month, except November and December.

Our next meeting will be Thursday, December 5, at 5:00 pm. **PLEASE NOTE THAT THERE IS NO MEETING IN NOVEMBER.**

The FAAC meets in the Ford Motor Credit Company (FMCC) building, conference room 1491, located on the lower east side of the building. FMCC is the low building immediately northeast of (but not attached to) Ford World Headquarters in Dearborn. The FMCC building is secured with a card entry system. The easiest way to enter the building for meetings is to park in the northeast lot (Employee Lot 7) and enter through the lower northeast or lower east doors. At 5:00 pm no one seems to have trouble getting in because many people are leaving around that time. At the east door you can dial 0911 on the security phone and say you are here to attend a Ford club meeting, and security will admit you. You may find your way into the building any way you see fit, but direction signs will only be posted at lower northeast and lower east doors. ☆

FAAC WWW PAGE

Please note that the address for the Ford intranet version of the FAAC WWW page is changing in November. The new address will be included in the next newsletter. ☆

STAR PARTY REGISTRATIONS

10/19/96 FAAC Island Lake Star Party

Star Party Visitor's Home:

Ann Arbor	4	Northville	12
Belleville	2	Novi	7
Brighton	2	Pickney	4
Canton	4	Plymouth	2
Dearborn	3	Redford	2
Dearborn Heights	3	Riverview	1
Detroit	5	Romulus	1
Farmington	2	Roseville	1
Fenton	1	Royal Oak	3
Grosse Isle	1	Saginaw	1
Hazel Park	2	South Lyon	4
Huntington Woods	1	Sterling Heights	1
Jackson	11	Troy	3
Lake Orion	1	Warren	1
Livonia	19	Westland	5
Milford	3	Ypsilanti	14
Mt. Clemens	1	Unspecified	4
New Hudson	2	**Total Registered = 133**	

Heard About Star Party From:

25	Member
19	Ford BB/E-Mail Distribution
13	School/Teacher
11	Friend of Member
11	Friend
10	Family Member
7	City Camera
7	Flyer
5	Boy Scouts
4	Eastern Michigan University
2	Island Lake State Recreation Area
2	Astronomy Magazine
2	Sky & Telescope
1	MDSTA Workshop
1	Web Page
1	W.A.S.

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NOVEMBER SPACE HISTORY

The following October events come from the 9/28/96 edition of "Space Calendar." This calendar is compiled and maintained by Ron Baalke (baalke@kelvin.jpl.nasa.gov).

Nov 04 15th Anniversary (1981), Venera 14 launch (Venus flyby/lander)
Nov 06 30th Anniversary (1966), Lunar Orbiter 2 launch
Nov 08 Edmund Halley's 340th birthday (1656)
Nov 11 30th Anniversary (1966), Gemini 12 launch
Nov 14 25th Anniversary (1971), Mariner 9 Mars orbit insertion
Nov 16 30th Anniversary (1966), Leonids meteor storm
Nov 27 25th Anniversary (1971), Mars 2 Mars orbit insertion/lander crash
Nov 29 35th Anniversary (1961), Mercury Atlas 5 launch ☆

NOVEMBER 1996 SPACE EVENTS

The following October 1996 events come from the 9/28/96 edition of "Space Calendar." This calendar is compiled and maintained by Ron Baalke (baalke@kelvin.jpl.nasa.gov). Note that launch dates are subject to change.

Nov 01 Galileo, Orbital Trim Maneuver #13 (OTM-13)
Nov 04 Galileo, 1st Callisto Flyby (Orbit 3)
Nov 06 Mars Global Surveyor Launch (Mars Orbiter)
Nov 06 Galileo, Europa Observations (Orbit 3)
Nov 08 STS-80, Columbia, Wake Shield Facility (WSF-03)
Nov 09 Galileo, Orbital Trim Maneuver #14 (OTM-14)
Nov 13 Hot Bird 2 Atlas Launch
Nov 13 Arabsat 2B/Measat-2 Ariane 4 Launch
Nov 14 Iridium-1 Launch
Nov 16 Mars '96 Launch (Russia)
Nov 21 Mars Global Surveyor, Trajectory Correction #1 (TCM-1)
Nov 27 Galileo, Orbital Trim Maneuver #15 (OTM-15) ☆

OBSERVING LOG

by Doug Bock, FAAC

October 19, 1996 - FAAC (rain date) 4th Annual Island Lake Star Party

It was cloudy when I got there. I set the 20" up anyway, and brought the slide show I prepared. There were 30 people there when I arrived. Hot Cider and donuts were out, and everyone was hoping the sky would clear. So while we were eating donuts cars kept roling in.

The clouds started breaking up about 6:30, and the scopes started springing up. We showed the public the moon for about an hour. Then it was time for the prizes and the slide show. Many youngsters were there for the evenings events. Bob MacFarland gave out door prizes until about 7:45 and then Greg Burnett and I gave a couple of slide shows on general astronomy and the Hubble Space Telescope. After that all the rest of the prizes were given out and we headed back to the scopes.

By now tho the clouds were back. We showed jupiter, saturn and the moon to the public until it clouded over totally. Being the optimist, we stuck around until about 11:00 PM before heading home. I'm not sure what the count was, but it looked like about 150 people showed up.

October 11-13, 1996 - Extra trip to NCO Wildwood Observing Site

It was clear friday night for a few hours. As twilight was going, we looked at jupiter first and noticed the Red Spot was prominent and face on to us. Seems it is reddening again. We dodged some clouds from time to time, but managed to observe Hale-Bopp, M57, M27, M56, M103, M51 very low on the horizon.

The next night, Saturday, was clear the entire night. We looked at jupiter again and caught a shadow transitting jupiter. It was IO's shadow. I put some power on it every 20-30 minutes to trace its progress. Also observed NGC7331 and Stephans Quintet. There were 9 of us observing here this night and we were rewarded with clear, but windy weather. Some high humidity, but still clear. ☆

NO SPEED LIMITS!!

by Kevan Granat, FAAC

I've seen articles in many publications about observing "too fast." More experienced observers sometimes get annoyed when novices look through the eyepiece and say "That's incredible... let's see something else now." Experienced observers have much more patience and better educated eyes; they can study faint objects for long periods seeking out nuances they've read about or seen in long-exposure photographs. But the beginner rarely has that sort of patience (trust me, I know first-hand).

At first I thought maybe I wasn't as interested in the hobby as others seemed to be. Now, though, I think every beginner goes through a similar stage. People just getting started in a hobby are hungry for some satisfaction and there's nothing wrong with hopping around the sky. Quickly jumping from one Messier object to another is an excellent way to learn your telescope and the night sky. I've had many nights when I've not looked at anything new, rather I simply jumped from one "known" object to another, learning by repetition.

But tastes do change... It seems that amateurs have a "main sequence" that the majority of us go through. Our first astronomical interest is invariably the moon. With the acquisition of some optical equipment, we typically shift our concentration to the planets and their moons. Then, on to the Messier catalog; sprinkling in some of the more prominent NGC objects and special events like comets and eclipses. Astrophotography and CCD imaging usually spark interests later (probably owing more to finances than observing experience). Then there's a fascination with double stars (which, I must admit, I don't share yet!). Of course, just like the star life main sequence, there are outliers; but, by and large, the trend seems sound.

So, next time you're out observing at 1 oph (Object Per Hour), don't hold anything back from the interested beginners. If they want to see seven M-objects, two planets, and a comet all in five minutes - help 'em out! (that's 120 oph - can they do that?) Nothing else, you'll amaze them with the richness of the sky that they were probably unaware of. ☆

OBSERVATIONS

by Greg Burnett, FAAC

...have to step outside for a dose of two-million-year-old light.

The Andromeda Galaxy is floating above my house. By the most recent measurement, it is 2,500,000 light-years away. The light I see, the light passing through my binoculars, being bent by the lenses, is old. For 2-1/2 million years it has been traveling in a dead-straight line through space. During the most recent millisecond or so, it's path was slightly disturbed by the atmosphere of the Earth. It bobbled just a bit as it passed through layers of air at various temperatures, pressures, and densities. In it's final moment, encountering the lenses and prisms of my binoculars, it popped through in a twinkling, and became part of me, combining with the chemistry of my retinas. Perhaps one or two photons were a gleam in someone's eye, a glint of summer light off a cresting wave, or a remnant of pale starlight through dark trees, softly illuminating lovers' passions; so very far away and long ago.

Nothing is lost from a photon. Though perhaps Doppler-shifted in color, it remains otherwise perfect through all its travels. Millions, billions may be launched from some tiny event, and many, perhaps most, may be absorbed immediately, their journeys measured in inches, meters, maybe a few miles. But some escape to us. They arrive intact, still fresh, still warm, still flush with the energy of their creation. Still perfect, having lost nothing, they bring us tidings from other worlds. ☆

STAR STUFF BOOK REVIEWS

Blind Watchers of the Sky
by Rocky (Edward W.) Kolb
Helix Books—Addison-Wesley Publishing Company, NY, 1996. HC $25.00.

This book is more about us than about astronomy. It is about how the human mind works, and how the methods of science help us overcome the frailties of our thinking. As Kolb states in the preface, "...a reader with no technical knowledge of astronomy, cosmology, or physics should be able to enjoy the book." This is true, because the book is not about those things. They are merely the vehicle for an investigation of scientific thought, the human reasoning that is science. Biology or geology would have served equally well.

The protagonists of the story are the great contributors to astronomy and cosmology: Aristotle, Ptolemy, Copernicus, Brahe, Kepler, Galileo, Newton, Herschel, Hubble, Einstein, and a large supporting cast. Through them the book explores heroic leaps of human intuition, when your suspicions go against everything known to be true, everything you grew up taking for granted, the very wisdom of the ages. For example, Kepler struggled mightily to distill the concept of elliptical orbits from the data of Tycho Brahe's observations. Why was it so hard? After all, an ellipse fit the data perfectly. It was hard because planetary orbits were perfect, and circular, and everybody knew it without question, and it had been so since the dawn of time. It took uncommon courage and insight for Kepler to break through the prevailing wisdom and embrace his three famous laws of planetary orbits. And yet, he went to his grave still pursuing the ill-conceived notion that the orbits of the then five known planets were is some way related to the five Platonic solids (tetrahedron, cube, octahedron, dodecahedron, and icosahedron).

The great minds of astronomy from all times saw a universe heavily colored by the knowledge and philosophies of their times. Even though they interpreted their observations with great intelligence, they were often blinded to what was really there before them. Many people today have a misconception of what "science" really is. Science is not a collection of facts, or a body of knowledge. Science is a way of thinking, a discipline necessarily imposed upon the noisy, distracted, and error-prone human mind, in order to ensure that, little by little, we will be able to assembly a useable understanding of the universe we inhabit. "Oh thick wits!" Brahe declared. "Oh blind watchers of the sky!"

— Reviewed by Greg Burnett, FAAC

Rocky Kolb is a professor of astronomy and astrophysics at the University of Chicago. He was the founding head of the NASA/Fermilab Theoretical Astrophysics Group at the Fermi National Accelerator Laboratory. ☆

PRONTO VS RANGER

by Jeffrey R. Hapeman (jhapeman@students.wisc.edu) via sci.astro.amateur

A fellow astronomer wrote to me to ask about purchasing a Ranger vs. Pronto, as well as recommendations. I recently went through a lengthy decision process and decided to buy the Pronto, for a variety of reasons. Below is my reply to him. I'll warn at the beginning that having bought the Pronto, I'm biased—I believe I made the right decision (given MY budget constraints).

If you're on a budget, I'd say the Ranger is a good choice—although you should be aware that the Pronto can be had with an 1 1/4" star diagonal for only $210 more than the Ranger. This would get you a) a much better constructed scope for only a slight price increase (the increase in quality between the Ranger and Pronto for the $210 is WELL worth it—I can't stress that enough, as you'll see) b) the ability to move up to a 2" star diagonal later, when you have more money (or maybe when Santa comes). The 2" diagonal allows you to take full advantage of the wide-field capabilities of the Pronto by using something like a 2" 55mm Plossl. The Ranger is impossible to upgrade to a 2" star diagonal.

Now, when I talk about the quality gain with the Pronto, I'm talking quality of construction. The optics are the same in the two scopes—but the cheaper price of the Ranger comes from shortcuts in construction. The Pronto is more ruggedly constructed of machined blocks of aluminum, has better adjustment for balancing, a built-in sliding aluminum dew/glare shield (optional rubber one available for Ranger), and a fine rack-and-pinion focuser (the Ranger has a slide tube and then a helical focuser, so you've got to focus twice, and end up with sticky grease from the slide tube—which I found annoying). The Pronto comes with a great padded case that has spaces to hold a number of 2" and 1 1/4" eyepieces—the Ranger has an optional case that does not include any eyepiece slots, and is not nearly as padded. Now this durability of the Pronto comes at a price: namely, weight. It weighs nearly twice as much as the Ranger—but still only weighs 6lbs—which I think is very reasonable.

So, bottom line—I feel the Pronto is a far better value, especially considering the fact that the case and glare/dew shield should really be bought for the Ranger, for obvious reasons. Buy the cheaper Pronto and you won't regret it—you might have some regrets about the Ranger in the future. I too, was on a budget when I got the Pronto, and agonized over buying the Ranger or the Pronto, but after seeing the two and comparing them, the choice was clear. A friend of mine decided to buy the Ranger and has now just sold it—he's saving up a little more money to get the Pronto. Here's a price comparison from a local mail-order business (which has very reasonable prices) that I sent to person who first inquired about my Pronto:

RANGER 90 star diagonal:	$548
Celestron Ultima 2x 1 1/4 " Barlow	$78 (great barlow at great price)
Tele Vue 40mm Plossl	$109
Tele Vue 10.4mm Plossl	$69
TOTAL	**$804**
PRONTO 90 1 1/4" star diagonal	$758
All the same accessories as above	
TOTAL	**$1014**

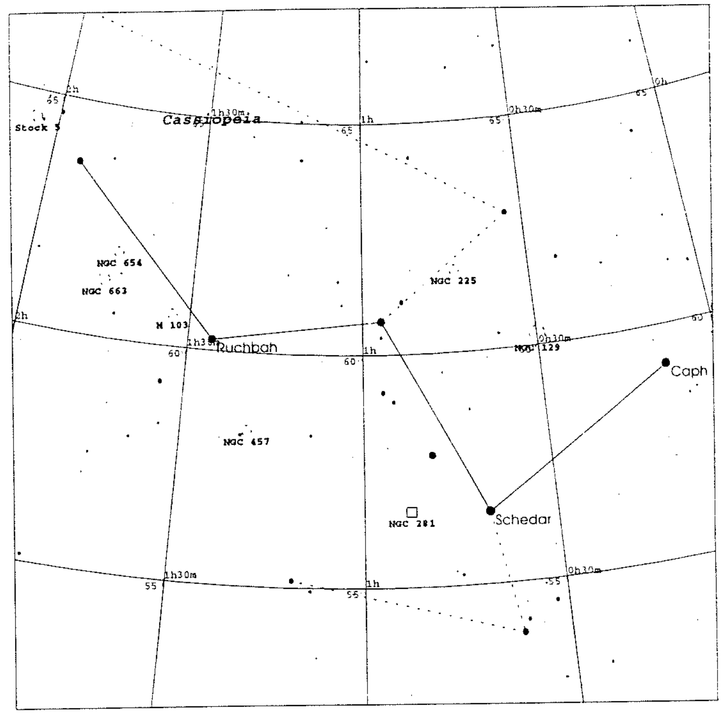
As I've explained above, the extra $210 for the Pronto is more than worth it. If you're on a tight budget, I suggest saving a little longer—you'll never regret getting the Pronto. It's not just a telescope, It's a piece of art, an engineering marvel. I spent many months laboring over my decision and actually sold my Questar to buy the Pronto. That may tell you something about this scope.

So, you can see I'm really biased toward the Pronto, and I think I've made a clear case why. Once you buy a case (which you should to protect such an expensive instrument) and dew/glare shield for the Ranger, you will have spent almost as much as you would have for the 1 1/4" Pronto, which while optically identical, is mechanically superior (and comes standard with better versions of both Ranger accessories). If you're selling two scopes with the same optics, and one is far cheaper, corners have to be cut somewhere—and I think the corners cut on the Ranger make it less of a value than spending the little extra for the Pronto.

Spend some time thinking before you purchase: the Pronto is so well made, I see it as a life investment. I believe my future child will cut their teeth on astronomy/birding with my Pronto, and their children probably will too. I'm not sure I could say the same for the Ranger. Remember that it's always better to save longer to get better equipment. That's a lesson I never fully learned until I bought the Pronto—hence my somewhat evangelistic tone. Hope you take all my suggestions in good light and think about them. In the end the choice is yours, and it must fit your desires and budget. ☆

NOVEMBER POINTS OF INTEREST

On the night of November 9, 1996, the constellation Cassiopeia will be near its highest point in the sky around 9:00 PM. While some people may be tempted to once again star-hop over to the nearby Double Cluster in Perseus, there are several other points of interest.



STOCK 5 (RA 2h 4.5m, DEC 64° 26')
Magnitude: 7.0 — Magnitude of brightest stars: 7.0
Size: 21' — Number. of stars: 35

NGC 654 (RA 1h 44m, DEC 61° 53')
Magnitude: 6.5 — Magnitude of brightest stars: 7.4
Size: 5' — Number. of stars: 60

NGC 663 (RA 1h 46m, DEC 61° 15')
Magnitude: 7.1 — Magnitude of brightest stars: 8.4
Size: 16' — Number. of stars: 80

M 103 / NGC 581 (RA 1h 33m, DEC 60° 42')
Magnitude: 7.4 — Magnitude of brightest stars: 10.6
Size: 6' — Number. of stars: 40
Notes: M103 is the last object in the original Messier catalog.

NGC 457 (RA 1h 419m, DEC 58° 20')
Magnitude: 6.4 — Magnitude of brightest stars: 8.6
Size: 16' — Number. of stars: 80

NGC 281 (RA 0h 53m, DEC 56° 37')
Magnitude: 7.4 — Magnitude of brightest stars: 9.0
Size: 4'

NGC 225 (RA 0h 43m, DEC 61° 47')
Magnitude: 7.0 — Magnitude of brightest stars: 9.3
Size: 12' — Number. of stars: 15
Notes: NGC 225 appears W-shaped.

NGC 129 (RA 0h 30m, DEC 60° 14')
Magnitude: 7.1 — Magnitude of brightest stars: 8.4
Size: 21' — Number. of stars: 35

Caph (Beta Cassiopeiae)
Magnitude: 2.25 — Absolute magnitude: +1.6
Luminosity: 19 Suns — Proper motion: 0.56"
Notes: A 14th magnitude optical companion exists at 23" separation. Beta Cassiopeiae is a pulsating variable, with an amplitude of about 0.05 magnitude in a period of about 2.5 hours. Beta Cassiopeiae is also a spectroscopic binary with a period of about 27 days. ☆

ASTRONOMY WORKSHOP

What does "seeing" mean?
by Jay Reynolds Freeman (freeman@netcom.com) via sci.astro.amateur

There is sort of a problem in using "seeing" to mean some mixture of Airy-disc steadiness and transparency, because these phenomena are not always related in an obvious way. There are meteorological conditions which simultaneously produce poor transparency and a very steady Airy disc. So if I hear someone use "good seeing" in the "mixture" sense, was there high transparency and jiggly diffraction patterns, or low transparency and steady discs, or (how lucky!) high transparency and a rock-solid diffraction pattern? That's why I try to separate the two terms in my own usage.

Measuring seeing in arc-seconds is perhaps more useful to persons taking photographs, or other kinds of images, that integrate the diffraction pattern fluctuations over a long time. One can lay down a ruler on the film and measure how big the resulting blurry star image is, and convert that into arc seconds. The result depends on lots of things that have to do with instrument, film, and exposure, too, but if you are looking at a picture, blur circle size is useful to know, for it gives a good handle on how much detail you can expect to see.

If you can see the diffraction pattern through an eyepiece, you of course have an immediate handle on image size in arc seconds, for its angular dimensions are easily looked up for various apertures. But what do you measure? Most people don't use a single number, they ask themselves questions like the following:

> Is the central disc of the diffraction pattern visible at all (or lost in the blur)?
> All the time, or just some of the time?
> What proportion of the time?
> Is it ever momentarily steady?
> How often?
> For how long?
> For what fraction of the time is it steady?

... and similar questions for the diffraction rings which surround the central disc, to which may be added

> How many rings are visible?

It is that kind of stuff that gets written down in my logbook when I wish to characterize seeing. The answers of course vary with aperture. There is a numerical scale, from 1-10, worst to best, which takes into account the most common combinations of answers to questions like this, but I can never remember it well enough to use it, so I log the details. ☆

FINDERS FOR TELESCOPES

by David Knisely, Prairie Astronomy Club, Inc.

The use of some sort of sighting instrument, or "finder" is required in order to put celestial objects in the main telescope's relatively narrow field of view. There are two basic types of finders: finderscopes, and unity-power "sight" finders.

FINDERSCOPES are small low-power wide-field secondary telescopes mounted alongside the main instrument in adjustable mounting rings for aligment with the main telescope. They usually have an eyepiece with crosshairs for object centering, and a wide field of view which is several times that of the lowest power field on the main telescope. Once the finderscope properly aligned with the main telescope, the user can put an object in the telescope's field by merely moving the main scope around until the object of interest appears centered in the finderscope's crosshairs. It should then be in the field of the main telescope. Some finderscopes have a source for low-level illumination of the crosshairs, which can be useful on a dark sky, as long as the illumination does not wash out the target stars. Many finderscopes use a star diagonal to put the viewing eyepiece in a more convenient position, although it does reverse the field, making reference to star atlases more difficult. Some amateurs solve this problem by making their own finderscopes with two star diagonals, but most just put up with the minor inconvenience of having to stoop a bit to look straight through the finder.

The minimum aperture for a finderscope is a subject of some debate. Most observers have difficulty seeing much through finderscopes with objectives smaller than 30mm, and for a "standard" finder, a 50mm aperture is recommended. As for magnification, the finder should have at least 7x of power and at least a five degree field of view, so that objects may be located easily. Some seasoned observers who go for very faint targets with large telescopes will even recommend using 60mm to 80mm finders in the 7-15x power range, although with the larger sizes, the number of faint stars visible with these large finders may end up confusing the inexperienced amateur.

1X FINDERS: These are just what the name implies: finders which do not magnify or enhance the view. They range from simple sighting tubes or gunsight-like devices, to illuminated reticle-type systems. The simple tube sights will get you in the ballpark, but in dark skies they can be a little hard to use. The "reflex" sights with illumination put an illuminated dot on a tilted glass plate, allowing the user to look through the plate at the sky, see the dot and place objects on it for finding. However, the object should be visible to the unaided eye for this to work well. Many amateur astronomers have built their own inexpensive dot-reflex finders from simple ones found on some gunsight systems.

One of the best known commercial 1x finders is the TELRAD, a reflex type finder which puts an unique three-ring reticle of adjustable brightness in the viewers field. The rings are 0.5 degrees, 2 degrees, and 4 degrees in diameter on the sky, and are most useful not as a simple bulls-eye, but as a "pattern maker", for star hopping. By using overlays which resemble the Telrad's reticle pattern on star atlases, and centering the target object's chart location in the overlay, star patterns and alignments with the Telrad rings in the area around deep-sky objects can be worked out which can then be duplicated by looking through the Telrad at the night sky. This can make finding even faint non-naked eye objects much easier than with the simple "dot" finders. The Telrad is a bit bulkier than some of the simpler "dot" sights, but it is very popular, especially among Dobsonian telescope users. As for which is better (Telrad Vs. Finderscopes), it really depends on the individual's preference. Many amateur astronomers use both a finderscope and a Telrad on their instruments for locating objects in the night sky. ☆

PHYSICS NEWS UPDATE

The American Institute of Physics Bulletin of Physics News (physnews@aip.org)by Phillip F. Schewe and Ben Stein

THE THEORY OF BIG BANG NUCLEOSYNTHESIS (BBN) tells the saga of how nuclei, especially deuterium, helium, and lithium, were made in the early minutes of the universe. Along with the microwave background and the mutual recession of galaxies, the observed abundance of primordial He, D, and Li is one of the chief supports of big bang cosmology. Recent measurements, however, suggest that BBN estimates for D and He-3 abundance are too high, and that the theory (or the observations) must be amended. Physicists at Berkeley (Erich Holtmann, holtmann@theorm.lbl.gov) and the University of Tokyo tackle this problem by invoking a hypothetical exotic particle. The presence of such a particle (with the right mass and lifetime) in the early universe might, in the act of decaying, have provided a torrent of gamma rays which dismembered deuterium (into two hydrogens) and He-3 (into H and D), bringing their numbers into line with modern measurements. He-4, more tightly bound that He-3, would be relatively immune to the marauding gammas. If this scenario is correct, the particle in question might well have been a "gravitino," the fermion cousin of the graviton. Gravitinos are ordained as part of "supersymmetry," a theory which holds that all known fermions (such as electrons or quarks) have hypothetical boson counterparts and vice versa. (Holtmann et al., upcoming article in Physical Review Letters.)

TeV-ENERGY GAMMA BURSTS from the galaxy Markarian 421, observed in May 1996, constitute the largest, purest flux of very high energy gamma rays yet recorded for an astronomical object. In one burst the flux increased above quiescent levels by a factor of 50 in an hour. A second burst 8 days later lasted only 30 minutes. The potency and brevity of such bursts (suggesting a source no larger than our solar system) provide new constraints on theories of energetic emissions from compact objects. The bursts were detected at the Whipple Observatory in Arizona, where air showers initiated by the incoming gammas show up as light in Cerenkov counters. (J.A. Gaidos et al., Nature, 26 September 1996.)

SOLAR NEUTRINO FLUXES VARY WITH A PERIOD OF 21.3 DAYS. This is the conclusion of Stanford scientists Peter Sturrock and Guenther Walther who examined years' of data from the Homestake (South Dakota), Kamiokande (Japan), and GALLEX (Italy) neutrino detectors. Possible causes of the periodicity include the rotation of magnetic fields inside the sun or a variability in the production of neutrinos in the solar core. (Science, 20 Sept.; New Scientist, 21 Sept.) ☆

STATISTICALLY SPEAKING

Location (Dearborn, MI): 42°19'12" N, 83°10'48" W, 180 meters elevation
Local Time = Universal Time - 5 hours (Eastern Daylight Time)

Abbreviations used in reports:

FM Full Moon	FQ First Qtr Moon	LQ Last Qtr Moon	NM New Moon
MR Moon Rise	MS Moon Set	SR Sun Rise	SS Sun Set

Calendar Report for Novemober 1996

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	Lunar Events Nov 03 LQ: 2:53 Nov 10 NM: 23:16 Nov 17 FQ: 20:10 Nov 24 FM: 23:10				1 SR: 7:06 SS: 17:26 MR: 22:40 MS: 12:22	2 SR: 7:08 SS: 17:24 MR: 23:35 MS: 13:00
3 SR: 7:09 SS: 17:23 MR: None MS: 13:35	4 SR: 7:10 SS: 17:22 MR: 0:31 MS: 14:06	5 SR: 7:11 SS: 17:21 MR: 1:28 MS: 14:36	6 SR: 7:13 SS: 17:20 MR: 2:26 MS: 15:05	7 SR: 7:14 SS: 17:18 MR: 3:25 MS: 15:35	8 SR: 7:15 SS: 17:17 MR: 4:25 MS: 16:06	9 SR: 7:16 SS: 17:16 MR: 5:28 MS: 16:40
10 SR: 7:18 SS: 17:15 MR: 6:32 MS: 17:17	11 SR: 7:19 SS: 17:14 MR: 7:36 MS: 18:00	12 SR: 7:20 SS: 17:13 MR: 8:40 MS: 18:48	13 SR: 7:21 SS: 17:12 MR: 9:42 MS: 19:43	14 SR: 7:23 SS: 17:11 MR: 10:39 MS: 20:44	15 SR: 7:24 SS: 17:11 MR: 11:31 MS: 21:49	16 SR: 7:25 SS: 17:10 MR: 12:16 MS: 22:57
17 SR: 7:26 SS: 17:09 MR: 12:57 MS: None	18 SR: 7:28 SS: 17:08 MR: 13:34 MS: 0:06	19 SR: 7:29 SS: 17:07 MR: 14:09 MS: 1:15	20 SR: 7:30 SS: 17:07 MR: 14:43 MS: 2:23	21 SR: 7:31 SS: 17:06 MR: 15:17 MS: 3:30	22 SR: 7:32 SS: 17:05 MR: 15:52 MS: 4:37	23 SR: 7:34 SS: 17:05 MR: 16:30 MS: 5:43
24 SR: 7:35 SS: 17:04 MR: 17:10 MS: 6:46	25 SR: 7:36 SS: 17:04 MR: 17:55 MS: 7:46	26 SR: 7:37 SS: 17:03 MR: 18:43 MS: 8:42	27 SR: 7:38 SS: 17:03 MR: 19:34 MS: 9:33	28 SR: 7:39 SS: 17:02 MR: 20:28 MS: 10:18	29 SR: 7:40 SS: 17:02 MR: 21:23 MS: 10:58	30 SR: 7:41 SS: 17:01 MR: 22:19 MS: 11:34

Planet View Info Report for November 1996

Date	Rise	Set	RA	Dec	Elongation	Ill Fr	DIST(AU)
Mercury							
11/ 5/1996	7:24	17:25	14h48m58s	-16°15'59"	1°51'35"	0.999	1.44217
11/12/1996	7:57	17:27	15h33m09s	-19°58'15"	5°58'47"	0.988	1.43813
11/19/1996	8:27	17:32	16h18m10s	-22°52'14"	9°49'59"	0.966	1.40663
11/26/1996	8:54	17:42	17h04m01s	-24°50'15"	13°27'14"	0.930	1.34737
Venus							
11/ 5/1996	4:10	16:03	12h31m33s	-1°35'23"	35°00'48"	0.805	1.25077
11/12/1996	4:26	15:55	13h03m13s	-4°48'37"	33°30'57"	0.825	1.29174
11/19/1996	4:42	15:48	13h35m20s	-7°59'14"	31°59'11"	0.843	1.33093
11/26/1996	4:59	15:41	14h08m03s	-11°02'51"	30°25'44"	0.860	1.36837
Mars							
11/ 5/1996	1:10	14:43	10h22m45s	11°54'39"	69°43'38"	0.911	1.68336
11/12/1996	1:01	14:25	10h37m09s	10°37'30"	73°00'12"	0.908	1.62415
11/19/1996	0:53	14:06	10h51m00s	9°21'14"	76°25'04"	0.905	1.56296
11/26/1996	0:43	13:47	11h04m17s	8°06'39"	79°58'43"	0.904	1.50008
Jupiter							
11/ 5/1996	11:58	21:03	18h58m41s	-23°00'59"	60°37'32"	0.993	5.56544
11/12/1996	11:36	20:41	19h03m54s	-22°53'49"	54°48'10"	0.994	5.65614
11/19/1996	11:13	20:20	19h09m29s	-22°45'25"	49°02'29"	0.995	5.74042
11/26/1996	10:51	19:59	19h15m22s	-22°35'44"	43°20'09"	0.996	5.81750
Saturn							
11/ 5/1996	15:43	3:36	0h07m24s	-1°59'26"	137°58'53"	0.999	8.74592
11/12/1996	15:15	3:07	0h06m18s	-2°05'16"	130°40'17"	0.998	8.82876
11/19/1996	14:46	2:39	0h05m28s	-2°09'06"	123°24'50"	0.998	8.92128
11/26/1996	14:19	2:11	0h04m56s	-2°10'51"	116°13'14"	0.998	9.02183
Uranus							
11/ 5/1996	13:01	22:27	20h13m09s	-20°30'59"	78°04'48"	0.999	19.97179
11/12/1996	12:34	22:01	20h13m52s	-20°28'34"	71°13'16"	0.999	20.08818
11/19/1996	12:07	21:34	20h14m45s	-20°25'38"	64°22'41"	0.999	20.19997
11/26/1996	11:41	21:08	20h15m46s	-20°22'13"	57°33'10"	1.000	20.30557
Neptune							
11/ 5/1996	12:37	22:02	19h48m22s	-20°38'54"	72°22'09"	1.000	30.44269
11/12/1996	12:10	21:35	19h48m54s	-20°37'42"	65°27'48"	1.000	30.55460
11/19/1996	11:43	21:08	19h49m32s	-20°36'13"	58°33'35"	1.000	30.66050
11/26/1996	11:16	20:42	19h50m15s	-20°34'28"	51°39'41"	1.000	30.75884
Pluto							
11/ 5/1996	8:11	19:13	16h10m23s	-8°25'25"	22°52'07"	1.000	30.84711
11/12/1996	7:45	18:47	16h11m25s	-8°29'38"	17°35'51"	1.000	30.87949
11/19/1996	7:18	18:20	16h12m28s	-8°33'34"	13°39'02"	1.000	30.89836
11/26/1996	6:52	17:53	16h13m32s	-8°37'10"	12°23'47"	1.000	30.90349

Planet/Moon Apsides Report for November 1996

11/ 2/1996	Venus @ Perihelion	Distance from Sun: 0.72 AU	
11/ 3/1996	Moon @ Apogee	Hour: 08 Distance: 404316 km	Diameter: 0.493°
11/ 3/1996	Moon @ Perigee	Hour: 23 Distance: 369468 km	Diameter: 0.539°
11/14/1996	Mercury @ Aphelion	Distance from Sun: 0.47 AU	

Planet Conjunction/Opposition Report November 1996

11/ 1/1996	Mercury @ Superior Conjunction	Hour: 18
11/24/1996	Pluto @ Conjunction	Hour: 18

Meteor Showers Report for November 1996

Date	Meteor Shower	ZHR	RA	DEC	Illum. Frac.	Longitude
11/ 2/1996	Taurids	8	3h44m	14°	0.55	221°
11/16/1996	Leonids	10	10h08m	22°	0.36	235°

Twilight Report for November 1996

Date	Sun Rise	Sun Set	Astronomical Begin	Astronomical End	Nautical Begin	Nautical End	Civil Begin	Civil End
11/ 5/1996	7:11	17:21	5:31	19:01	6:04	18:28	6:37	17:55
11/12/1996	7:20	17:13	5:39	18:55	6:12	18:22	6:45	17:48
11/19/1996	7:29	17:07	5:46	18:50	6:19	18:17	6:53	17:43
11/26/1996	7:37	17:03	5:53	18:47	6:26	18:14	7:01	17:39

☆

SKY & TELESCOPE NEWS BULLETINS

from the editors of Sky & Telescope magazine

A FINE ECLIPSE

Although most everyone in North America had front-row seats for the total lunar eclipse on September 26th, stormy weather spoiled the view for much of the east-central United States. Those who did see it found the eclipsed Moon a little brighter than in past years; on the 0-to-4 Danjon brightness scale most viewers put this event at 2 or 2.5. Distinct reddish coloring was evident, especially near the beginning of totality, which offered a nice change from the generally drab appearance of recent years. In Lawrence, Kansas, Craig Paul found the Moon dark enough at mideclipse that even the distinct rays of the crater Tycho were invisible. Robert Lightbown in Caribou, Maine, was pleasantly surprised by how much more of the starry sky could be seen during totality. Many observers in central Massachusetts witnessed a dazzling fireball just as the penumbral phase of the eclipse began.

A special treat throughout the event was nearby Saturn, which coincidentally reached opposition on the 26th as well. Through a modest telescopes the planet's rings formed a thick bar. Many observers were startled by the presence of satellites Tethys, Rhea, Titan, and Iapetus strung out to the planet's west. This was the last total lunar eclipse observable from North America until the year 2000, though a very deep partial eclipse takes place next March 23rd.

IUE: RIP

For the world's oldest operating astronomy satellite, the International Ultraviolet Explorer, the end has finally come. IUE was switched off September 30th after more than 18 years in synchronous orbit. Its final target was auroral emission on Jupiter. The shutdown was necessitated by cuts in the European Space Agency's science budget; NASA funding for the satellite was curtailed last year. IUE's ultraviolet spectrometers provided a generation of astronomers with an unprecedented window on high-temperature stars, mass-exchanging binarie stars, and the interstellar medium.

MILKY WAY HEAVYWEIGHT

It's becoming more obvious that a massive black hole lurks in the heart of the Milky Way. That notion is based on the motions of stars seen only arcseconds from our galaxy's radio-bright core. Skeptics have pointed out that those stars might be moving in highly eccentric orbits, which would make the calculated mass of the central object artificially high. But new measurements by Andreas Eckart and Reinhard Genzel (Max Planck Institute) show that massive stars near the core are moving, on average, by equal amounts in all directions. Calculations based on that fact argue for a dark, central object that packs the mass of 2.4 million Suns into a space only a fraction of a light-year across.

DOUBLE-DIPPING METEOR

Meteor specialists are still trying to piece together evidence for what may be the first known "double-dipping" meteor. At about 8 p.m. on October 3rd a bright fireball was widely seen heading east-northeast over New Mexico and northern Texas. Then, 100 minutes later, another dazzling streak appeared over central California. It seems these were the same object, one which first skimmed through the atmosphere, made a single orbit around Earth, then plunged in again for a fiery finale. There's also speculation that the intruder dropped meteorites near Kernville, California, near the southern end of the rugged Sierra Nevada. John Wasson, a meteorite specialist at the University of California, Los Angeles, is offering a $5,000 reward for anyone who turns in a meteorite from this fall weighing 4 ounces or more.

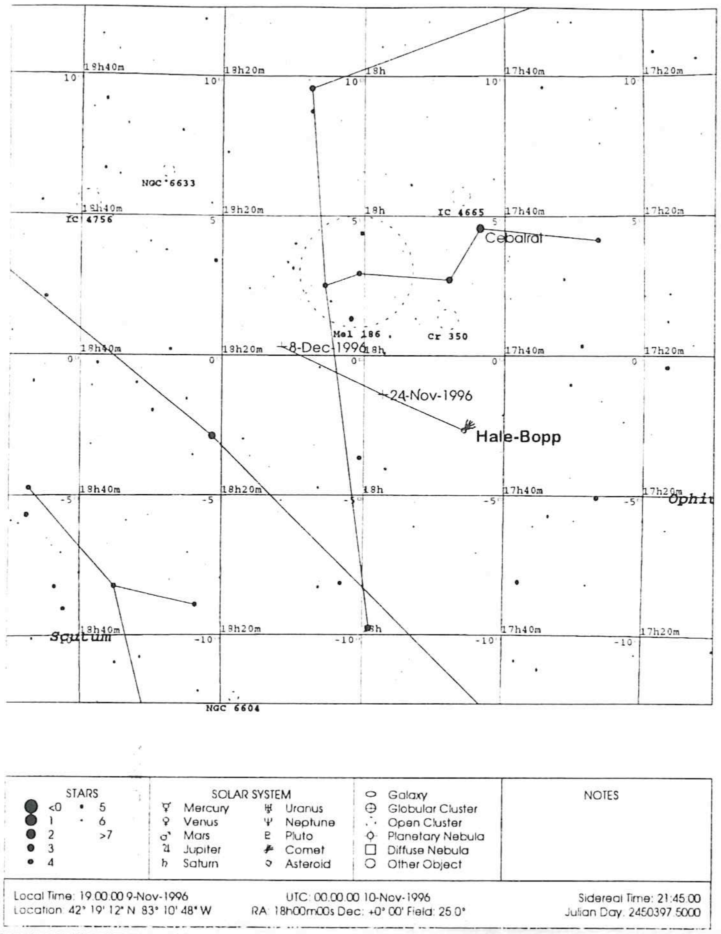
OCTOBER 12th's SOLAR ECLIPSE

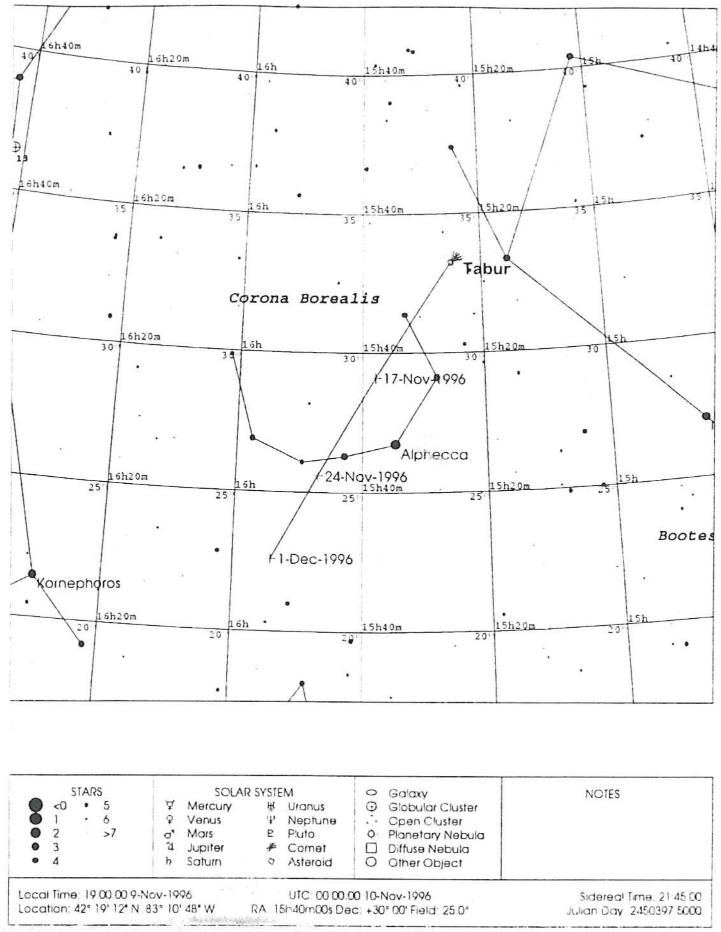
The partial eclipse of the Sun on October 12th was a mixed success. Observers report generally clear skies in southern Europe and Israel. But farther north, where the Moon's bite into the solar disk was more pronounced, clouds generally ruled. One innovative feature for this event was the ability to see it worldwide via live "webcasts" available from several sites on the Internet.

NOTHING TO SPOT

According to solar observer Casper Hossfield, the complete drought of sunspots continues into its sixth week. Sunspot records show that the Sun hasn't been this boring since 1933. But we're still well short of the all-time record of 92 spotless days in 1913. ☆

FINDING COMETS HALE-BOPP AND TABUR (11/9/96)





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